S/N 10/889,072
Grp 3629
4-04

(12) UK Patent Application (19) GB (11) 2 268 569 (13) A

(43) Date f A Publication 12.01.1994

(21) Application No 9214640.6

(22) Date of Filing 09.07.1992

(51) INT CL[5]
F16D 7/02

(52) UK CL (Edition M)
F2U U202 U206 U212 U214 U254 U262
U1S S1847

(56) Documents Cited
GB 2061457 A GB 1598589 A GB 1244742 A
GB 1243826 A

(58) Field of Search
UK CL (Edition L) F2U
INT CL[5] F16D 1/02 1/08 1/12 7/02
Online databases:WPI

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(54) Overload couplings

(57) A friction coupling comprises an inner member 2 and an outer member 6, each of which may be made of or have a surface of a friction reducing material (eg tin - bronze) so that damage is avoided during slippage between the members when overloading occurs. The surfaces are capable of being expanded, for example by hydro - mechanical means, in order to adjust the overload limit. A friction bush 14 may be situated between the members so that friction surface 16 engages with friction surface 18 upon hydraulic pressurisation of cavity 20. The cavity is pressurised to a predetermined limit so that slippage occurs at a specific torque limit. The friction bush 14 may be made of a friction reducing material, eg aluminium - bronze, tin bronze etc, or alternatively its surface may be coated with such a material. Each of the friction surfaces may be provided with grooves to aid lubrication, cooling etc.

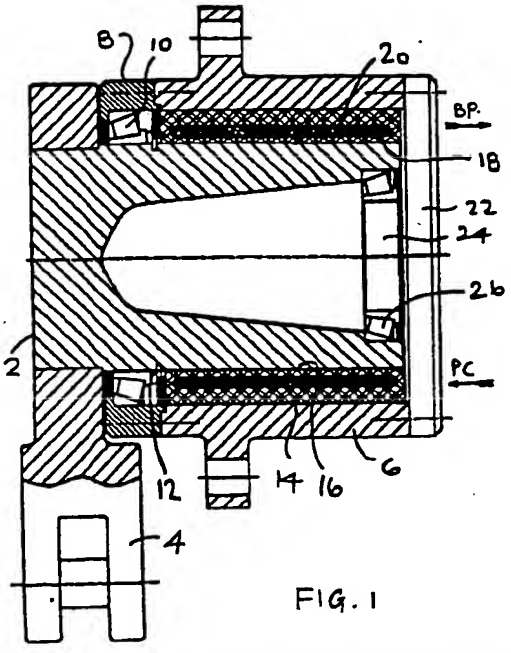

FIG. 1

At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

The claims were filed later than the filing date within the period prescribed by Rule 25(1) of the Patents Rules 1990.

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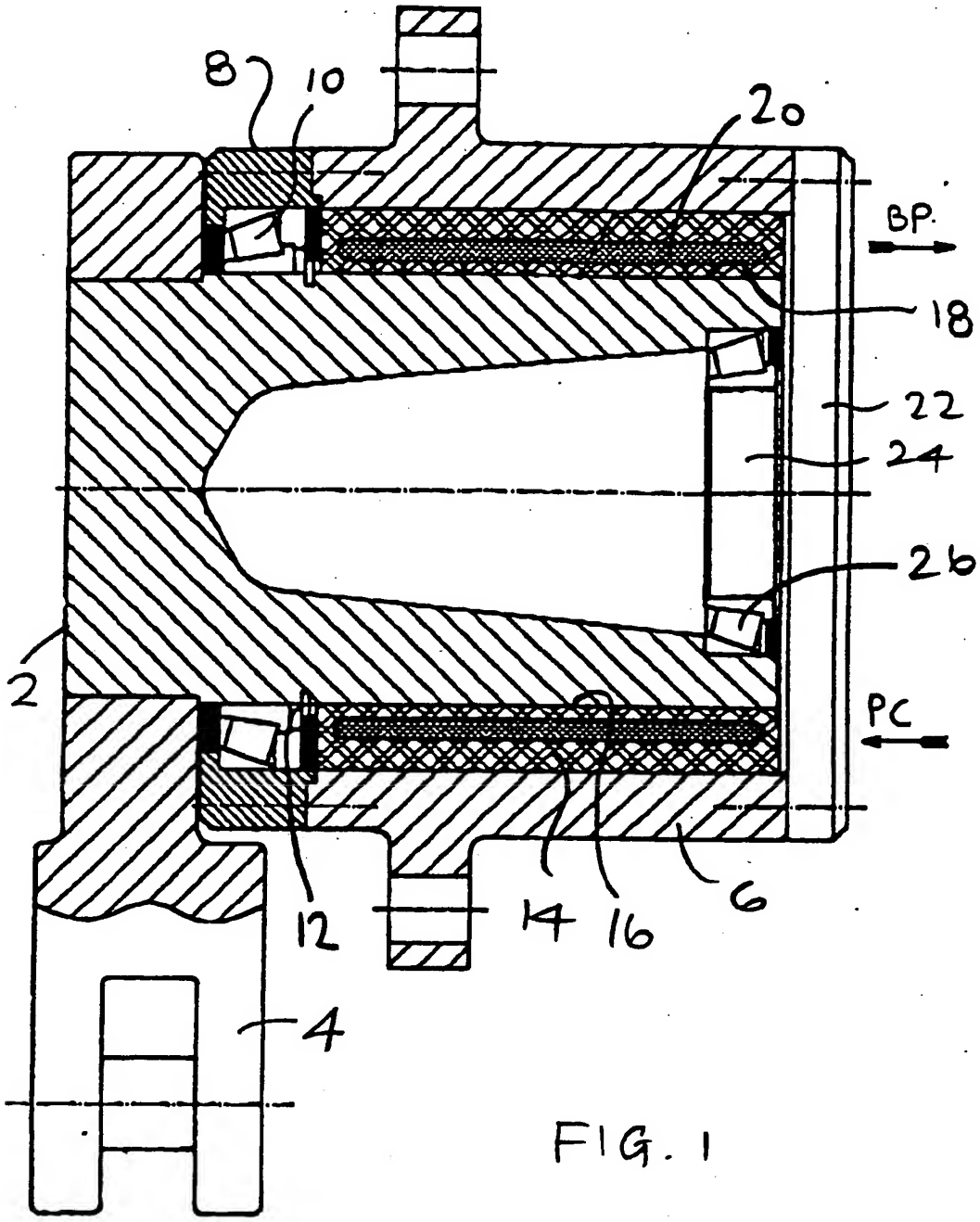

FIG. 1

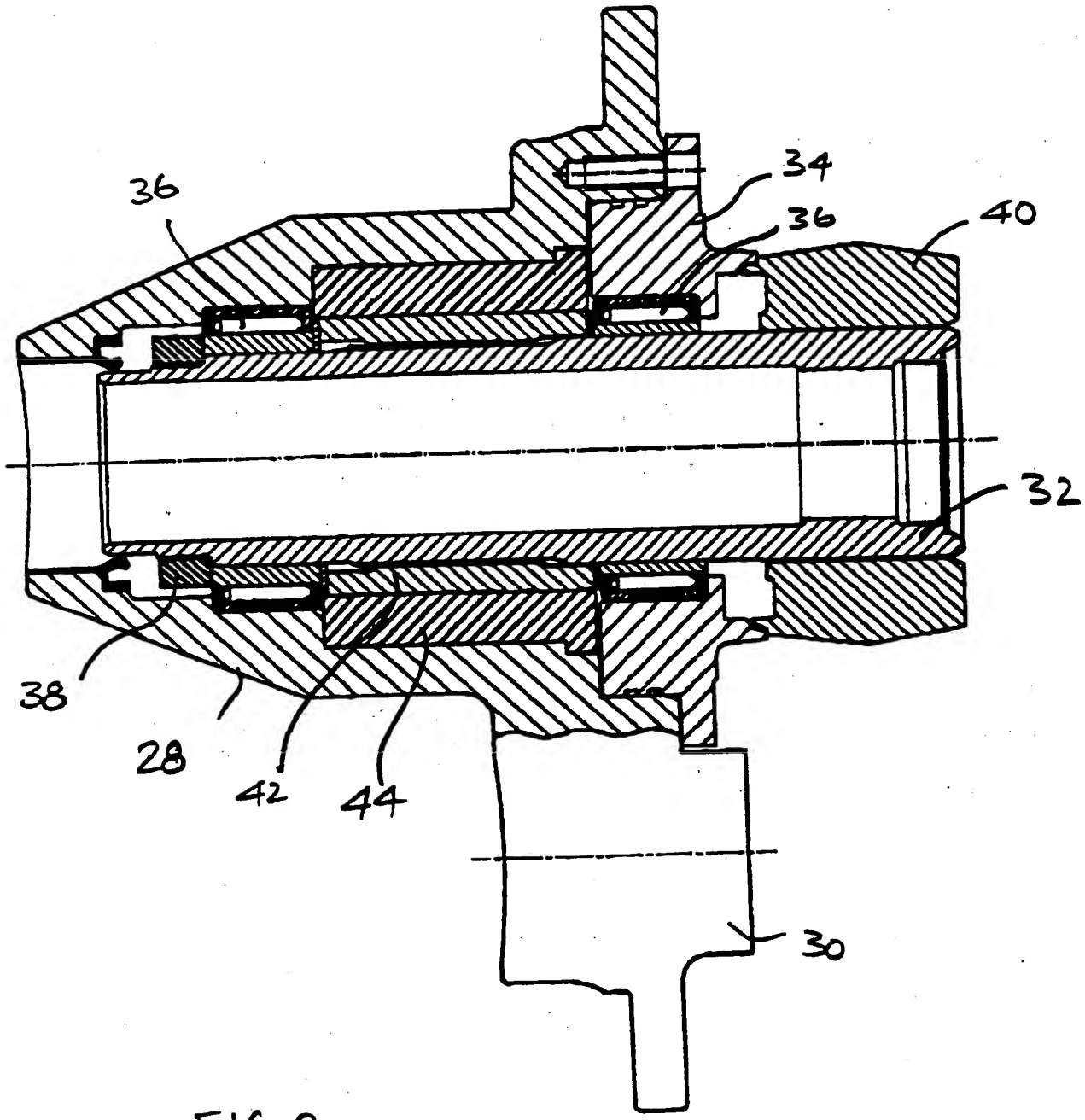

FIG. 2

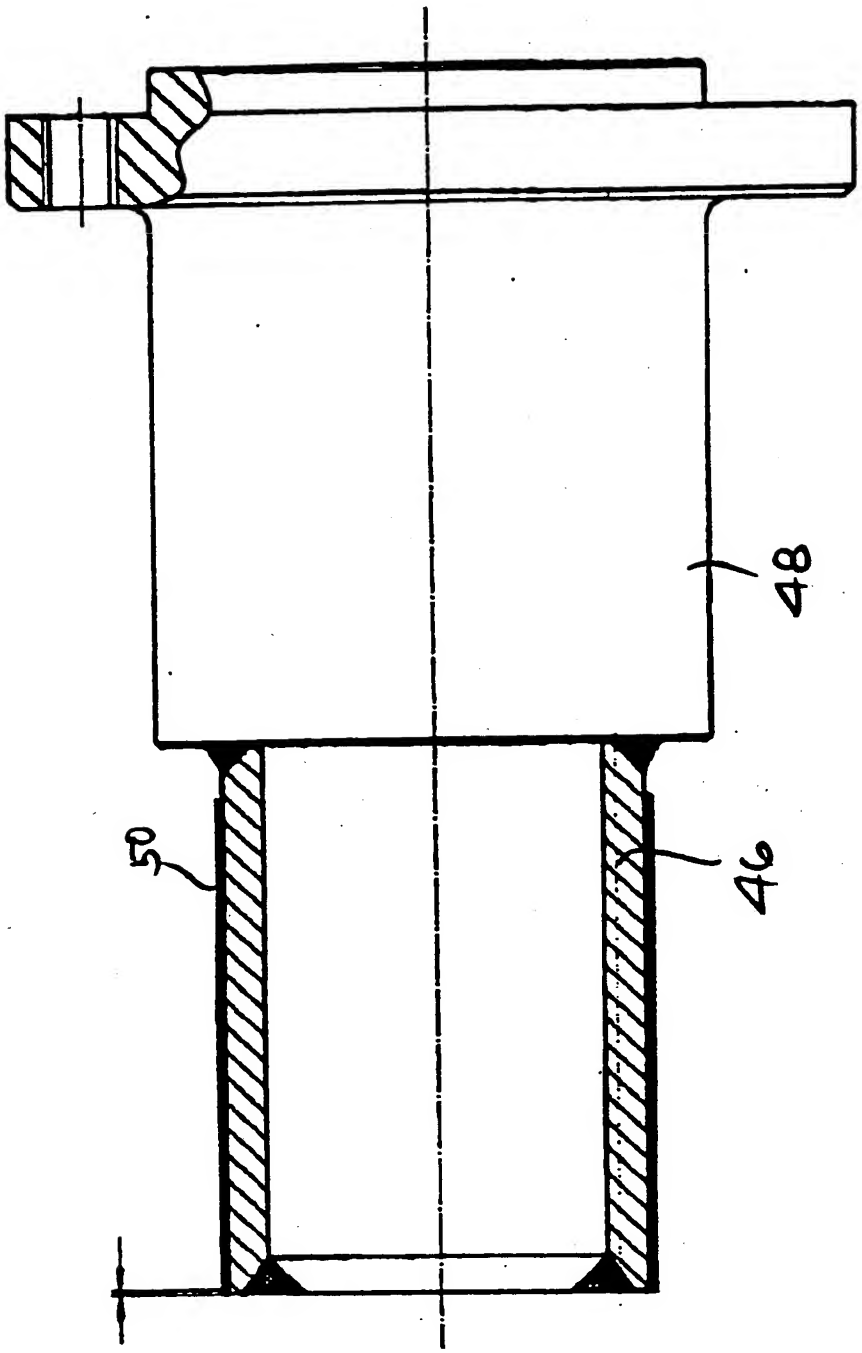

FIG. 3

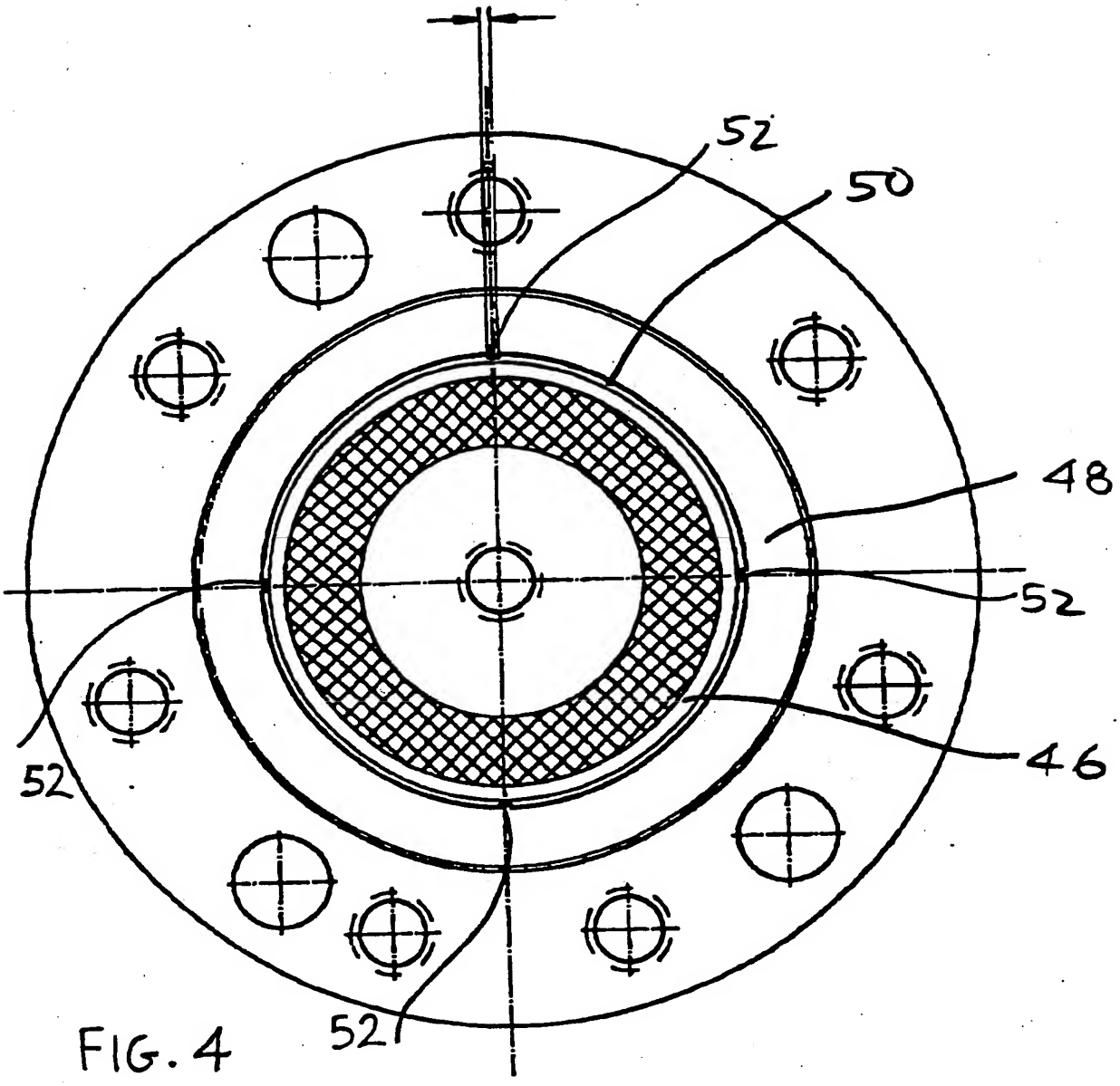

FIG. 4

OVERLOAD COUPLINGS

This inv ntion relates to ov rload couplings.

Overload couplings are used in circumstances where excessive torques may be encountered. For example, if a large, heavy object has to be accelerated rapidly from rest, or if its direction of movement has to be changed rapidly, large inertia forces may be applied to the drive mechanism. These inertia forces, if excessive, may cause damage to the components of the drive mechanism.

To avoid such damage, it is known to incorporate, in the drive mechanism, a multiple plate clutch which will slip if excessive torque is applied to it. This protects the components of the drive mechanism from the inertia forces. However, such multiple plate clutches are relatively large, particularly if they have to transmit large torques, and they tend to introduce backlash into the drive line.

GB-A-2245339 discloses a frictional coupling comprising a shaft engaged within a bush. The bush has an annular chamber with a frusto-conical surface, in which an annular frusto-conical piston is movable. Hydraulic pressure applied to the chamber at one end of the piston forces the piston axially of the bush to exert a wedging action. This causes the internal diameter of the bush to decrease, so locking it frictionally on the shaft. Once frictional locking has occurred, the hydraulic pressure can be released, since the wedging action on the piston keeps it in position. To release the frictional engagement of the bush on the shaft, hydraulic pressure is applied to the chamber at the other end of the piston.

While such frictional couplings provide a releasable connection between two components, they have not proved suitable for protection against overload. If the coupling is engaged, and sufficient torque is

applied to caus slip betwe n th shaft and the bush, severe surface damage to one or the other component results.

According to the present invention there is provided a friction coupling comprising inner and outer members which are received one within the other and engage each other at respective friction surfaces, at least one of the members being provided with means for adjusting the diameter of its friction surface, the friction surface of at least one of the members being adapted to avoid damage to the friction surfaces upon slippage between the members.

The means for adjusting the diameter may be hydromechanical means, such as is disclosed, for example, in GB-A-2245339.

One of the members may be made from, or coated with, a friction-reducing material such as aluminium-bronze or tin-bronze. The material may have a significant nickel content. Where the friction reducing material is a coating applied to the surface of the member, the coating is preferably thin in order to reduce thermal effects between the coating and the base material which may, for example, be steel.

The friction surface of one or both members may be provided with formations, such as grooves, in order to aid lubrication, cooling and the dispersal of debris at the friction surfaces. In a preferred embodiment, shallow annular grooves are provided in the internal surface of the outer member, and axial grooves are provided on the outer surface of the inner member. For example, four of the axial grooves may be provided at 90° spacing.

Where the inner member is gripped unevenly by the outer member, there will be regions of the friction surfaces which are subject d to locally high contact pressure. Thus, if relative slip occurs betw en the

m mbers, damage to the members may be accelerated in these regions. To alleviate this problem, surfac formations, such as circumferential grooves, which reduce the local contact pressure, may be provided on one or both members in these regions.

For a better understanding of the present invention, and to show how it may be carried into effect, reference will now be made, by way of example, to the accompanying drawings, in which:

Figure 1 is a sectional view of a friction coupling;

Figure 2 is a sectional view of another embodiment of friction coupling;

Figure 3 shows a component of a third embodiment of a friction coupling; and

Figure 4 is a view in the direction of the arrow IV in Figure 3.

The coupling shown in Figure 1 comprises an inner member in the form of a stub shaft 2 which carries a lever arm 4. An outer member in the form of a hub 6 is mounted coaxially on the stub shaft 2. A bearing retainer 8 is bolted to one end of the hub 6 and encloses a tapered roller bearing 10. The bearing 10 is held in place by a retainer ring 12, so as to keep the hub 6 in position on the stub shaft 2.

A friction bush 14 is situated between the hub 6 and the stub shaft 2. The friction bush 14 has an inner friction surface 16 which engages an outer friction surface 18 of the stub shaft 2.

The friction bush 14 is hydro-mechanically actuable so as to adjust the diameter of the friction surface 16. For this purpose, the friction bush 14 includes an arrangement 20 (shown only diagrammatically) which can receive hydraulic fluid under pressure so as to forc the friction surfac 16 radially inwards into firm engagem nt with the

frictional surface 18 of th stub shaft 2. This arrangement may, for example, be similar to that disclosed in GB-A-2245339.

At the end away from the bearing housing 8, the hub 6 is fitted with an end plate 22 having a spigot 24. A tapered roller bearing 26 pilots the stub shaft 2 on the spigot 24.

The coupling shown in Figure 1 may, for example, form part of a vehicle suspension. The hub 6 may be secured to the vehicle chassis or body, and the suspension arm 4 may be connected to a wheel carrier. For normal suspension movement, the arrangement 20 is released, so that the stub shaft 2 can rotate within the hub 6. This allows normal suspension movement of the wheel carrier.

In some circumstances, for example if lifting gear on the vehicle is to be operated, it is desirable to prevent normal suspension movement in order to avoid movements of the body of the vehicle under the influence of lifting loads. Under these circumstances, the arrangement 20 is actuated to reduce the diameter of the friction surface 16, so as to clamp the stub shaft 2 firmly. In this condition, however, it is possible that excessive loads may be applied to the suspension, for example if there are sudden changes in the direction of movement of the lifting gear, or if excessive loads are suddenly applied to the lifting gear. If the suspension of the vehicle remains rigidly locked, some components of the vehicle could break, with expensive and possibly dangerous consequences. To avoid this danger, the hydraulic pressure applied to the arrangement 20 is set to a value such that the frictional engagement between the friction surfaces 16 and 18 is not sufficient to transmit a torque above a predetermined threshold between th stub shaft 2 and the hub 6. Thus, if the torque exceeds th

pr determin d thr shold, th stub shaft 2 will rotate r latively to th hub 6.

In order to avoid damage the friction surfaces 16 and 18, one or both of these surfaces is specially adapted. For example, either or both of the friction surfaces 16 and 18 may be provided with a friction-reducing coating, or with appropriate formations. This will be discussed in greater detail with reference to Figure 3.

Figure 2 shows an alternative form of coupling. In this embodiment, a hub 28 provided with a suspension arm 30 is mounted on a hollow steel shaft 32. An end ring 34 is secured to the hub 28, and the hub 28 and end ring 34 are rotatably mounted on the shaft 32 by means of needle roller bearings 36. The hub 28 is axially located on the shaft 32 by a retaining ring 38 at one end and a collar 40 at the other. The shaft 32 is provided, between the bearings 36, with a splined sleeve 42 of friction-reducing materials, such as aluminium-bronze or tin-bronze with a significant nickel content. This sleeve is surrounded by a friction bush which operates in a similar manner to the friction bush 14 of the embodiment of Figure 1.

The embodiment of Figure 2 operates in substantially the same manner as Figure 1, with the hub 28 being selectively rotationally secured, with overload protection, to the shaft 32 by actuation of the friction bush 44. Other friction-reducing measures may be applied at the interface between the sleeve 42 and the friction bush 44 in order to avoid damage to these components when slippage occurs as a result of excessive torque.

Figures 3 and 4 represent a test piece for evaluating the performance of friction couplings construct d in accordance with the principles of the embodiments of Figur s 1 and 2.

A ste l sleeve 46 is welded to a steel shaft 48. The sleeve 46 has applied to it thin coating 50 of a friction-reducing material such as aluminium-bronze or tin-bronze with a significant nickel content. As shown in Figure 4, four equally spaced axial grooves 52 are machined in the coating 50. These grooves have a width of 2mm and a depth of 0.75mm, the outside diameter of the sleeve being 90mm.

In addition to the grooves 52, circumferential grooves may be provided, either in the coating 50 or in the inner surface of the friction bush 14 (Figure 1) or 44 (Figure 2).

CLAIMS

1. A friction coupling comprising inner and outer members which are rec ived one within the other and engage each other at respective friction surfaces, at least one of the members being provided with means for adjusting the diameter of its friction surface, a friction surface of at least one of the members being adapted to avoid damage to the friction surfaces upon slippage between the members.

2. A friction coupling as claimed in claim 1, in which the means for adjusting the diameter is hydro-mechanical means.

3. A friction coupling as claimed in claim 1 or claim 2, in which one of the members is made from a friction reducing material.

4. A friction coupling as claimed in any one of the preceding claims, in which one of the members is provided with a coating of a friction reducing material.

5. A friction coupling as claimed in claim 3 or 4, in which the friction reducing material is aluminium-bronze or tin-bronze.

6. A friction coupling as claimed in claim 5,in which the composition of the friction-reducing material includes nickel.

7. A friction coupling as claimed in any one of the preceding claims,in which at least one of the members is provided with surface formations.

8. A friction coupling as claimed in claim 7, in which the surface formations comprise circumferential grooves.

9. A friction coupling as claimed in claim 8, in which the circumferential grooves are provided in the friction surface of the outer member.

10. A friction coupling as claimed in claim 7 or 8, in which the surface formations comprise axial grooves.

11. A friction coupling as claimed in claim 10, in which the axial grooves are provided in the friction surface of the inner member.

12. A friction coupling as claimed in claim 11, in which four axial grooves are provided at 90° spacing around the circumference of the friction surface of the inner member.

13. A friction coupling as claimed in any one of claims 10 to 12, in which the axial grooves have a width of 2 mm and a depth of 0.75 mm.

14. A friction coupling substantially as described herein, with reference to, and as shown in Figures 1, 3 and 4 or Figures 2, 3 and 4 of the accompanying drawings.

Patents Act 1977
Examiner's report to the Comptroller under Section 17 (The Search Report)

Application number

GB 9214640.6

Relevant Technical fields

(i) UK Cl (Edition L) F2U

(ii) Int Cl (Edition 5) F16D 1/02, 1/08, 1/12, 7/02

Search Examiner

MIKE MCKINNEY

Databases (see over)

(i) UK Patent Office

(ii) ONLINE DATABASES: WPI

Date of Search

15 SEPTEMBER 1993

Documents considered relevant following a search in respect of claims

Category (see over)	Identity of document and relevant passages	Relevant to claim(s)
X	GB 2061457 A (FFV INDUSTRIPRODUKTER) see Figures 1 and 2 and lines 101 to 112 page 1	1,2,3,4 AND 5
X	GB 1598589 (WEAN UNITED) see Figure 1 and line 10 page 3 and lines 126 to 130 page 3	1,2,3,4 AND 5
X	GB 1244742 (JAMES A JOBLING) see Figure 1 and lines 35 to 41 page 2	1,3 AND 4
X	GB 1243826 (JAMES A JOBLING) see figure and lines 49 to 88 page 2	1,2,3 AND 4

Category	Identity of document and relevant passages	Relevant to claim(s)

Categories of documents

X: Document indicating lack of novelty or of inventive step.

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A: Document indicating technological background and/or state of the art.

P: Document published on or after the declared priority date but before the filing date of the present application.

E: Patent document published on or after, but with priority date earlier than, the filing date of the present application.

&: Member of the same patent family, corresponding document.

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